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Leopold Center
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COMPETITIVE GRANT
REPORT
93-15

Biological control of the tarnished plant bug in Iowa

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Entomology

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Budget
$2,000 for year one
$1,500 for year two
$1,000 for year three

Abstract: *TPB, the tarnished plant bug* (Lygus lineolarisj, *attacks strawberries in Iowa and the Midwest. The egg parasitoid* (Anaphes \o\e*) has been observed to parasitize TPB in several crops in the western United States, but its activities have not been studied in strawberries in the Midwest. Under laboratory conditions, it was determined that A.* iole *will parasitize TPB eggs in strawberry stems. Releases of A.* iole *females in large field cages containing low densities of TPB eggs did not result in successful parasitization.*

Background

A key insect pest attacking strawberries in the Midwest is the tarnished plant bug (TPB) or *Lygus lineolaris.* It is found on a variety of crops, including forage legumes such as alfalfa and vetch, as well as many fruit and vegetable crops. Feeding by TPB nymphs on developing fruits causes misshapen strawberries and significantly reduces quality and yield of marketable fruit. Iowa strawberry growers typically spray for TPB on a calendar basis because of the pest's high damage potential.

Two new biological control options for the TPB are based on the establishment of new parasitoid species from Europe in the United States, and the mass rearing and commercial production of the egg parasitoid *Anaphes iole* by a company in California. During the 1980s, USDA biological control researchers in Delaware established a series of braconid wasps from Europe that parasitize immature stages of the TPB. With this imported natural enemy, they hope to permanently establish a new biotic mortality factor for TPB. During 1993 and 1994, densities of the TPB and these parasitoid wasps were very low in Delaware and New Jersey. Because of these low densities, the USDA project researchers were unable to provide these parasitoids for release and testing in Iowa.

This altered the project to focus on releases of the commercially produced egg parasitoid *{Anaphes iole)* for suppression of TPB. *Anaphes iole,* which occurs throughout the United States, is the nation's primary egg parasitoid *of Lygus* species (especially *Lygus hesperus* in the western United States) and attacks *Lygus* on a wide variety of crops. California researchers have used annual releases of the commercially grown egg parasitoids to reduce *Lygus hesperus* densities in strawberry fields. But no studies have been done to determine if *A. iole* can be used to battle TPB in Iowa.

The objectives of this study were to determine that A. *iole* will indeed parasitize the TPB and to release this wasp in strawberry fields and quantify the level of TPB parasitism.

Approach and methods

Laboratory studies: Tarnished plant bug eggs were exposed to the egg parasitoid at three different times in the greenhouse. Prior to exposure to the adult parasitoids, the plants were trimmed to two stems per pot. The plants were then moved to an environmental growth chamber.

A piece of dialysis tubing was placed over each strawberry stem and the ends closed to form a cylindrical exposure arena. Field-collected TPB adults were placed in each tube for 72 hours. The TPB adults were removed and *A. iole* adults were released in the enclosure and allowed to lay eggs until the death of the parasitoids. TPB nymphs and adult parasitoids were collected and counted every two days. After no parasitoids or nymphs had emerged for two days, the strawberry stems were examined for presence of TPB eggs.

Field releases: Caged releases were conducted at the Iowa State University Horticultural Research Station in June 1995 using strawberry plots that had not been sprayed for two seasons. Five hundred *A. iole* adults were released into each of four field cages placed over strawberry plants infested with TPB eggs. Ten strawberry stems from each cage were removed from the field and held in the lab for parasitoid emergence or hatching of TPB nymphs.

Results and discussion

1993: Weather conditions were not favorable for TPB populations in Delaware and New Jersey this year. As a result, parasitoid wasps *{Peristenus digoneutis)* were not available from the USDA cooperators in Delav/are, so no collections and releases of this species were made in 1993. However, strawberry release plots were established at the ISU Horticultural Research Farm in 1993.

1994: As in 1993, densities of the TPB and parasitoid *(P. digoneutis)* wasps wens below levels required for collection in New Jersey and Delaware. The strawberry plots at the ISU Horticultural Farm were maintained. Data on the population and density of the TPB collected from these plots in 1994 and 1995 indicated that the TPB produced one generation within the Junebearing strawberry plots. This provided a basis for timing the release of *A. iole* in these plots in 1995.

Laboratory studies with A. iole: A. iole adults were reared from the TPB eggs in the dialysis tubing cages, which indicates that A. *iole* will attach and develop within TPB eggs found in strawberry stems. TPB nymphs began to emerge from unparasitized eggs in about seven days, *A. iole* started to emerge from parasitized host eggs in about two weeks. It was observed that one *A. iole* female would parasitize more than one TPB egg.

Field release of A. iole: No A. iole adults were reared from strawberry stems removed from field cages The densities of TPB eggs in the sample stems were very low, averaging less than one egg per stem.

Conclusions

Innundative releases of *A. iole* have reduced numbers of *Lygus hesperus* in California strawberry fields. Results of the lab studies show that A. *iole* will parasitize *L. lineolaris* eggs in strawberry stems. *A. iole* has been observed to parasitize an average of 10 *Lygus* species eggs per day in several different plant hosts. Given that, the parasitism rates in this lab study were much lower than expected. These factors may have contributed to the low parasitism rates:

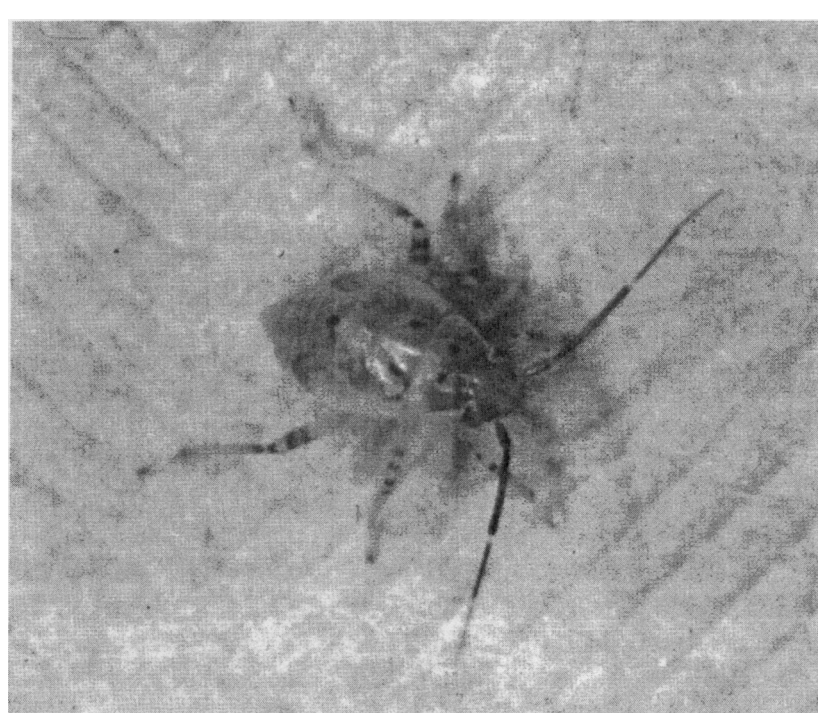
1) Minor desiccation of the strawberry stems within the dialysis tubing
2) No supplemental food source (e.g. honeywater) was provided for the parasitoids
3) TPB eggs may have been too old for optimal parasitism

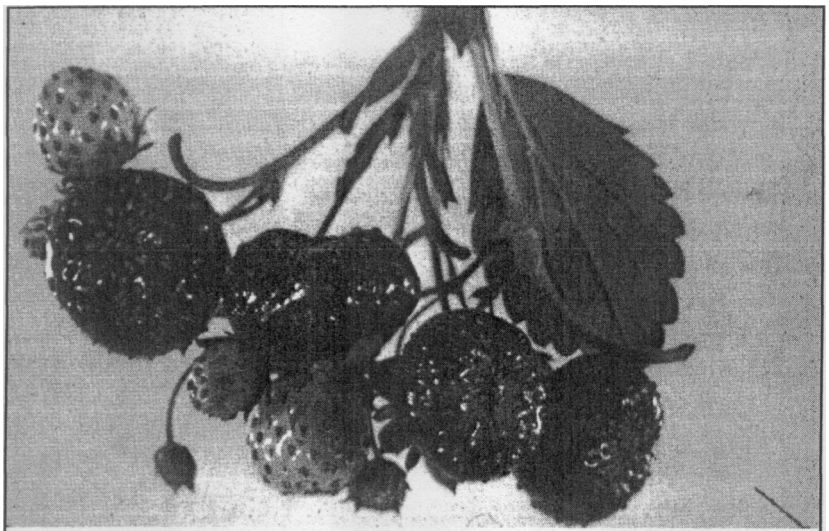
Lack of recoveries of *A. iole* from field cage releases was believed to be due to the low TPB egg densities in the field cages. Sampling 10 stems from each cage was likely too small a sample size to detect parasitism at this very low host egg density.

Implications

The TPB is the pest of greatest concern for Iowa strawberry growers. Due to its wide plant host range and high mobility, it is a

Tarnished plant bug nymph





Strawberries injured by tarnished plant bug.

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difficult insect to manage in strawberry fields. Currently strawberry growers in Iowa have no options other than insecticide use to suppress the TPB. Thus, further field releases of A. *iole* are needed to be determine optimal timing of releases and number of A. *iole* needed to achieve TPB suppression. In addition, because A. *iole* females provided with a carbohydrate food source live longer and deposit more eggs, studies of the effects of food sprays used in conjunction with A. *iole* release are needed.

As part of the Strawberry IPM Extension/ research team at ISU, researchers are developing reliable sampling methods for TPB, as well as examining biological and cultural control tactics for this pest.

Education and outreach

Information from this study was presented at 1994 grower field days held at the ISU Horticultural Research Station and at the Muscatine field station. Further findings were presented at the Strawberry Workshop section of the Iowa Fruit and Vegetable Growers meeting in January 1996 and in the strawberry IPM newsletter.